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#### THE HAMADRYAD OR KING COBRA, NAIA HANNAH. (Cantor).

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# COLONEL F. WALL, C.M.G., K.H.S., I.M.S. (With a plate)

#### (Read before the Bombay Natural History Society at a meeting held on the 22nd July 1924.)

Many notes have appeared in this Journal from time to time on this remarkable snake, and allusion has been made to it by various authors in other publications.

Since I came to India 29 years ago I have collected a good deal of information concerning its habits which I have recorded in my note books. I have been careful, however, to accept information from reliable sources only. I think it may interest our Members to have all the available information about the species incorporated into a paper, from which they may learn what is already known, and how they may further advance our knowledge of its life-history.

SYNONYMY.—Hamadryas hannah. Cantor, Asiat. Research, XIX, p. 187, Plates X-XII (1836).

Hamadryas ophiophagus. Cantor, P. Z. S., p. 32 (1839); and Cat. Mal. Rept., p. 116 (1847).

Trimeresurus ophiophagus. (part) Dum and Bibr., VII, p. 1245 (1854). Hamadryas elaps. Gunther, Cat., p. 219(1858).

Trimeresurus bungarus. Jan., Rev. and Mag. Zool., p. 129 (1859,) and Icon. Gen. 44, Plate IV (1873).

Naja fasciata. Peters, Mon. Berl. Acad., p. 689 (1861).

*Ophiophagus elaps.* Gunther, Rept. Brit. Ind., p. 341 (1864); Stoliczka, J. A. S., Beng., XXXIX, p. 210 (1870); Anderson, P. Z. S., p. 188 (1871); Fayrer, Thanatoph. Ind., Plates VII and VIII (1874); Phipson, Bomb. N. H. J., Vol. II, p. 245 (1887); Boettger, Ber. Offendb. Ver. Nat., p. 86 (1888).

Naja elaps. Theobald, Cat. Rept. Brit. Ind., p. 209 (1876).

Naja ingens. Von Hasselt, Versl. A. K. Amsterd., XVII, p. 140 (1882).

Naja tripudians Var. Sumatrana. Muller, Verh. Nat. Ges. Basel., VIII, p. 277 (1887).

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Ophiophagous bungarus. Beddard, P. Z. S., p. 355 (1904).

NOMENCLATURE.—(a) Scientific. "The generic name written as Naja was conferred by Laurenti in 1768, having been borrowed from Linne's earlier specific title given to the cobra in 1754. The name was evidently suggested by the Hindustani name for the cobra, viz., "nag". Naja was retained for many years, but evidently altered to "*naia*" owing to the Latin alphabet containing no letter j.

(b) English.—It is familiarly known to all Europeans as the hamadryad or king cobra.

(c) Vernacular.—" Krishna Nagam" (Black snake) of Tamils in South Indua. "Karinchathai" of the jungle tribes about Travancore. "Karinagam" and "Krishna Sarpam" (King Snake) among Tamils in Travancore. "Karlinga haow" (Black snake) by the Canarese in Mysore State. " Nagin and Kalinagin" of North Canarese (Fenton). "Ai-raj" of Ooriahs in Orıssa. "Sank-chor" and Sha-kha-muti (Cantor) of Bengalis. "Fetty sap" ("hooded snake" applied also to the cobra) of Assamese about Tezpur (Mr. Gardiner "in epistola"). "Mutti-fetty" of Assamese ab base of Naga Hills (Mr. Gore "in epistola"). B'sein-yong" ("Black snake") of the Khasis about Shillong (Mr. Rita "in epistola"). "Gnan-bok". and "Gnan-gnan-bok" of the Burmese (Evans). "Gnan-bok" and "Gnan-than-gwin-soh" of Burmese around Taungdawgye (Mr. Little "in epistola"). "Hkram-chang" (Black hamadryad), "Hkram-sit" (Yellow hamadryad), and "Hkram-mut" (Grey hamadryad) of the Kachins (Mr. Leonard "in epistola"). "Gni-son-an" of the Shans (Evans), and "Gni-thaw-plaw" and "Gni-thaw" of the Karens (Evans).

HISTORY.—The first allusion to it appears to be Cantor's in 1836. Schlegel was the next to mention it in 1837. Since then almost every writer on Indian Snakes has referred to it.

GENERAL CHARACTERS.—It is the third largest snake found within the limits of the Indian Empire. The head is moderate in size and markedly depressed. The snout is gently bowed in profile, rounded at its extremity, and shows little indication of a canthus. Behind the eyes the temples are swollen to correspond with the underlying poison glands. The nostril is fairly large, and occupies the full depth of the suture between the nasal shields. The eye is moderately large, being about the same diameter as its distance to the nostril. The pupil is rounded and the pupillary edge of the iris golden or golden-brown. A neck is barely evident. The body is fairly robust and roundish, and just behind the head is capable of expansion to form a "hood ", which is relatively less dilatable than in the cobra. The scales are glossy. The tail is moderate in length, being about one-fifth to one-sixth the total length of the snake.

IDENTIFICATION.—The pair of occipital shields are peculiar to this snake. The costals are in 17 to 19 rows two heads-lengths behind the head, 15 in midbody, and 15 two heads-lengths before the vent and characteristic of this species with the one exception of the rare Bengal snake, *Elachistodon westermanni*. The latter has only two labials touching the nasals, (the 1st and 2nd) whereas the hamadryad has three (the 1st, 2nd, and 3rd).

COMOURATION.—Inadults the prevailing dorsal colouration varies from a blackish-brown to a light olive-brown, but every gradation of hue is seen between these two extremes. There are from 32 to 43 lighter bands round the body, and from 11 to 13 round the tail. These are conspicuous in juvenile specimens, and gradually become less well-defined or even obscured as age advances, those in the posterior part showing these changes to a more marked degree. The bands involve one or two scales in the length of the snake, and the intervals from five to seven scales. The light shade in the band is more conspicuous on that part of the scales that is overlapped, so that the bands are much more evident when the snake under excitement expands itself than at other times. In Burma the natives recognise two species, basing their views on the extremes of colour just referred to. Evans tells us that they call the dark variety "gnan-bok" and the light one with more conspicuous bands "gnan". The head is olivaceous-brown, the shields being narrowly edged with black. The throat is creamy to dull orange merging to a dark mottling which becomes further back a uniform slatish or brown.

Hatchlings are so different from adults that anyone unfamiliar with snakes, and relying on colour instead of shield characters, would unhesitatingly fail to recognise them as hamadryads. The prevailing colour is intense black, and the bands are pure white, so that they bare a very close superficial resemblance to Cantor's Krait. (Bungarus bungaroides). Further the head is intense black with white markings. These consist of a bar across the top of the rostral and anterior part of the inter-nasals, a thicker bar across the posterior part of the præfrontals, a thin bar at the back of the supraoculars and frontal interrupted at the fronto-supraocular sutures, an oblique stripe converging with its fellow along the outer edge of the parietals, and an oblique stripe from the end of the last passing round the side of the throat.

HABITS—(a) Haunts.—The hamadryad is a denizen of dense jungles, and in Peninsular India is confined to hills or their near vicinity. It frequently climbs into trees, and thus obtains a vantage point among the foliage, from which it can advantageously view its surroundings, and rush down upon any suitable victim moving in the scrub below, engage, overpower, and swallow it. It is frequently seen in or near streams, and will readily take to the water if pursued.

(b) Disposition.—This snake has earned for itself a very unenviable reputation for its aggressiveness and courage, and is probably unrivalled in the snake world for these disagreeable traits, with the single exception of the South African mamba, a snake of somewhat similar proportions.

I have collected a great deal of information about its character from reliable sources apart from what is available from snake literature. There is no doubt that the hamadryad will sometimes attack without provocation, other than being confronted in its natural haunts. A notable instance is that reported by Raby Noble in this Journal (Vol. XV, page 358) when one attacked a cooly woman. One could cite many other similar incidents. The female when disturbed in the process of brooding her eggs, seems to be specially sensitive, and usually attacks the intruder at sight. Several instances are recorded where a jungle path has become closed to the wayfarer, owing to a brooding female and her mate attacking any one attempting to pass. When actually molested the snake frequently accepts the challenge, and attacks with great determination and ferocity. On the other hand even a large hamadryad will sometimes fail to attack on great provocation, being more concerned for its own safety. A good instance is that narrated by Colonel Evans in this Journal (Vol. XXVII, page 955) where a large specimen was rudely hustled by natives with bamboos, and by barking dogs, but slunk off rather than fight. A good instance of its courage recently came to my notice, Major Fraser, I.M.S., motoring with his wife down the Gudalur Ghat in the Nilgiri Hills, saw a large snake crossing the road in front of him, which he took to be a python. He tried to go over it, and thinks that he may have gone over its tail. The snake erected itself in a flash, and Mrs. Fraser seeing its head on a level with the top of the door and in close proximity to her, threw herself across her husband who was at the wheel, to avoid being struck. Major Fraser stopped the car, got out and found the snake was in the middle of the road with its head reared and facing right and left in a very threatening manner. He hesitated—with only a butterfly net in his hand—how he should act, when the snake came straight for him down the road at an alarming pace. Major

Fraser wisely got back into the car released the brakes and free wheeled for a hundred yards or so, and again got out. The hamadryad was still in the road with reared head and expanded hood, but suddenly ceased its menacing attitude and slunk off into the scrub. When encountered and not molested there is no doubt many specimens will retire without attacking. Mr. Hauxwell of the Indian Forest Department, quoted by Evans, from his experience of the snake in Burmese jungles, seemed to be sceptical as to its aggressiveness and thought that in nine cases out of ten the snake sought retirement in preference to hostilities.

(c) Striking Posture.—Like the cobra, the hamadryad under excitement erects its forebody a considerable height from the ground, and flattens the body just behind the neck to form the so called "hood". At the same time it expands its body and presents a most formidable appearance. I have not been able to ascertain with any certainty to what degree it can erect itself, but would estimate this as equal to the same muscular feat in the cobra, viz., about one a third its length. The incident referred to in which Major Fraser figured, shows that a large specimen can raise its head to about the height of the top of the door of a Ford car. This proves to be 3 feet 9½ inches.

The bite is a determined one, the snake maintaining its hold tenaciously. Mr. Raby Noble's account of one retaining its grasp on the leg of a cooly woman for eight minutes exemplifies this point, and those who have witnessed its encounter with other snakes have remarked upon this peculiarity.

(d) Nocturnal or Diurnal.—It evinces a markedly diurnal habit. Nearly all the encounters one hears about happen in broad daylight.

(e) Progression.—Its movements during attack are singularly rapid, and those who have fled before it in the jungles are very insistent that they had to use their utmost endeavours to escape.

(f) Hissing.—When alarmed and in an aggressive mood it hisses vehemently.

(g) Slovghing.—Cantor recorded that one in captivity desquamated every three or four months.

(h) Longevity.—Phipson (P.Z..S., 1887, page 639) mentions one that lived in Regent's Park for 12 years and 7 months.

FOOD-The staple diet of this species is snakes, but I have four records of lizards of the family Varanidæ (the iguanas of Europeans in India) being swallowed. Any snake seems to be victimised, whether harmless or poisonous, and even small species are not despised on account of their size. I have records of its practising cannibalism, and also of swallowing the following other poisonous snakes: the cobra (Naia naia), the banded krait (Bungarus fasciatus), and the whitestriped coralsnake (Doliophis bivirgatus). It will sometimes attack the python, Mervyn Smith in his book "Sport and Adventure in the Indian Jungle "(page 19) says he shot a hamadryad thirteen feet in length in the act of swallowing a python eight feet in length. Mr. Donaghy of the Survey of India sent me two dry snake skins to examine with the following history. When in the Toungoo District of Burma his coolies encountered two snakes in conflict. The smaller, a python, (P. reticulatus) had fastened its jaws upon the body of the larger snake which proved to be a hamadryad. The coolies killed them both. In the skin of the hamadryad there was a considerable rent where the python had seized its opponent. The hamadryad's skin measured ten feet, three and a half inches, and the python's seven feet eleven inches. As the python rarely if ever evinces a taste for other snakes in its natural haunts, it is probable the hamadryad was the assailant in this contest. Mr. Aitken in this Journal (Vol. XIV, p. 629) mentions one killed on the Goa Frontier in the act of eating a python, three feet of which was already swallowed. The hamadryad measured twelve feet one inch, and the python nine feet two inches. 

Among harmless snakes the ratsnake (*Ptyas mucosus*) is frequently victimised, and others I have records of are the green whip snake (*Dryophis mycterizans*); Blyth's keelback (*Rhabdophis platyceps*), Anderson's wolf snake (*Lycodon fasciatus*), and Blyth's snake (*Blythia reticulata*). The two last were found inside the same hamadryad.

Major Firth wrote to me of a hamadryad encountered by a Gurkha sepoy at Takdah near Darjeeling, which was coiled round a "malsampra" (the pine martin, *Mustela flavigula*). The sepoy threw a stone at them, and the snake left its victim, and attacked the sepoy who luckily killed it with a stone. It seems probable that the snake had no intention of swallowing its opponent, but aitacked and killed it as it is wont to do other creatures that cross its path. The late Major K.L.W. Mackenzie told me of an incident where a sepoy of the 62nd Punjabis at Buxa Dooars was stalking a khakur in the jungle which he shot. A hamadryad was—unknown to him at first—also stalking the khakur, and when the latter was shot the snake rushed at him. The sepoy killed it and it measured nine feet eleven and a half inches.

In captivity the hamadryad feeds voraciously. A specimen in Regent's Park ate eighty-two snakes in one winter, but refused all other food offered to it, *viz.*, eggs, lizards, rats, guineapigs, and pigeons.

BREEDING.—(a) The Sexes.—There is no evidence to show whether one sex grows to a greater length than the other. From my notes there is nothing to show that the ventral and subcaudal shields vary in the sexes.

(b) Mating.—Mr. Foster of Sallebile in the Kadur District, Mysore, came upon two in the act of mating at the beginning of March, and shot them. No record of their respective lengths is available. Mr. Jacob of the Indian Forest Service told me of two that were killed in the act of mating at the end of April or early May on a tea estate near Jalpaiguri.

(c) Method of reproduction.—There is definite proof that this species is oviparous.

(d) Season,-Eggs have been found in the months of April and May. Colonel G. H. Evans records two instances of nests containing eggs found at the end of April or early May in Burma. Mr. Millard told me of a female killed on eggs in Kanara in May 1392. Mr. Harrison told me of a female encountered on eggs in Assam in the middle of May 1907, and another killed in similar circumstances on the 15th of May 1908. All those who have met the hamadryad during the period of incubation have remarked upon the fact that the female has been coiled up on a nest of leaves, or vegetable rubbish. How this nest has been prepared there is no evidence to show, and it would be interesting to know if the snake gathers these leaves together, and if so how. It seems most probable she selects a chance accumulation of debris which she can appropriate for her usc. The female from these reports remains with her eggs for sometime. In the instance reported by Mr. Wasey in this Journal (Vol. VII, page 257) where he shot a hamadryad on her nest, he says that the eggs contained embryos that were formed and breathing." Whether the dam remains with her clutch until they hatch is not known. During the incubation period there is no doubt at any rate in some instances, that the male is in close attendance on his mate.

The two hatchlings obtained for me in the Nilgiris were killed at the end of May, on either the 25th, 26th, or 27th. From this it is probable that eggs may be deposited earlier than April.

(e) Period of gestation.—Nothing known.

(f) Period of incubation.—Nothing known.

(g) The eggs.—I have records of six broods in which the eggs varied in number from 21 to 33. I have never seen the eggs nor do I know of any observations having been recorded of their measurements.

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GROWTH.—(a) The hatchling.—The young snake on emergence from the egg measures about 20 to 21 inches. In 1917 I acquired two specimens killed in close proximity on the same day on Pilloor Estate in the Nilgiris. It seems almost certain therefore that they were newly hatched. These measured respectively  $20\frac{1}{4}$  and  $20\frac{3}{4}$  inches. Stoliczka also obtained a young specimen in Moulmein that was  $20\frac{1}{4}$  inches, but there is no record of the date of capture.

(b) Maturity.—I have no certain knowledge of the length of incubating females, but one of those referred to already, killed by Mr. Harrison in Assam, he reported to me was small "probably eight or nine feet."

(c) Maximum length.—I have two records of specimens over fourteen feet, viz., fourteen feet five inches and fourteen feet six inches. Fifteen feet five inches is the largest authentic specimen I know of. This is on the authority of Mr. Millard. Another specimen killed in the Travancore jungles by Lieutenant Branson many years ago appears to have been just the same length from the cutting I have from "The Pioneer" where it appeared at the time of the incident. Colonel Pollok in his book "Wild Sports of Burma and Assam" (page 114) reports one "over sixteen feet", but as the specimen was alive on exhibit in the street of Shooyghein, the length must be accepted with hesitation as snakes, especially large ones, are very difficult to measure during life. I have had many stories told me of lengths exceeding this, but wherever I have been able to procure the skin of the specimen referred to, I have proved the reported length considerably exaggerated.

POISON.—(a) Physical characters.—Cantor remarks on the fresh poison that it is a pellucid, tasteless fluid, which slightly reddens litmus paper. When kept its acid reaction is intensified.

(b) Amount injected at one bite.—Rogers by laboratory experiment estimated with some doubt, that about ten lethal doses (for man?) could be discharged at one bite. The amount injected however will vary with the length of time the bitten part is grasped, and I have already remarked upon the evil disposition of this snake to retain its hold.

(c) *Toxicity.*—Lamb by experiment on rabbits found the venom as virulent as cobra venom. Rogers by experiment on pigeons estimated the virulence as rather less than that of cobra venom.

(d) Uncertainty of effects.—Dr. Nicholson reported the case of a Burman snake catcher who was bitten by a ten foot specimen in good condition. He chewed some vegetable pulp, and applied it to the wound and was none the worse for the bite. Cases however that escape a lethal dose being injected into a wound must be rare.

(e) Cause of death.—Acting like cobra and other colubrine poisons, death is due to paralysis of the respiratory centre, and the terminations of the nerves which supply that important respiratory muscle the diaphragm, viz., the phrenics.

(f) Interval before death.—Evans records the death of a man bitten by a specimen 9 feet 7 inches long in quarter of an hour. The cooly woman mentioned by Raby Noble, bitten by a specimen ten feet one inch, succumbed in twenty minutes.

(g) Treatment.—No antivenene is available as a curative agent against this poison. Even if there were, accidents are likely to occur in jungles far removed from medical advice. The interval between the bite and death usually leaves little time in which to act. The best that can be done is to keep the patient warm and give, if available, hot soup or hot coffee, hoping that the dose injected has been something sublethal. I know of no case of a bite in a European. No case has been reported giving medical notes of any value.

LEPIDOSIS.—(a) Typical Rostral.—Depth  $\frac{3}{4}$  to  $\frac{3}{5}$  the breadth; rostro-internasa and rostro-nasal sutures subequal and greater than the rostro-labials. Inter nasals.—A pair. The suture between the fellows  $\frac{2}{3}$  to  $\frac{3}{4}$  that between th prefrontal pair. Præfrontals a pair; the suture between the fellows  $\frac{2}{5}$  to  $\frac{1}{2}$  th

length, of the frontal. Supraoculars.-Length subequal to præfrontal and internasal taken together, subequal to the frontal,  $\frac{3}{2}$  to  $\frac{3}{4}$  the parietals, rather greater than both temporals; breadth subequal to the frontal. Frontal.--Touches six shields; length subequal to the snout,  $\frac{3}{5}$  to  $\frac{3}{4}$  the parietals. Occipitals.—A pair. Nasals.—A pair. Loreal.—Absent. Præocular.. One. Postoculars.—Three. Temporals.—Two. Well developed and subequal. Supralabials.-Seven; the 1st, 2nd, and 3rd touching the nasals, 3rd and 4th the eye, 5th, 6th, and 7th the temporal. The 3rd is the deepest, and the 7th the longest of the series. Infralabials .- Five, the 4th and 5th which are subequal touching the posteror sublinguals. Cuneate .--- None. Sublinguals .-- Two pairs; subequal. The posterior is guite separated by a scale of about the same size. Costals .-- Two heads lengths behind the head 17 usually (sometimes 19); at midbody 15; two heads-lengths before the vent 15. The reduction of rows from 15 to 17 occurs about two and a half to three heads-lengths behind the head, and the fourth row above the ventrals is absorbed. The scales are smooth. Vertebrals slightly enlarged. Subjacent rows except the penultimate and ultimate oblique. Ventrals .- 225 to 262 (215 to 262, Boulenger). Anal.-Entire. Subcaudals.-76 to 93 (80 to 117, Boulenger. These figures include specimens from the Malay Peninsula and Archipelago which have more numerous shields than Indian examples). They are mostly divided, but there are nearly always a few at the base of the tail entire, and some specimens after divided shields have been established show entire shields again interruptedly.

DENTITION.—From six skulls in my collection. Maxilla.—Fangs 2; canaliculate, showing shallow groves on their anterior faces where the surrounding walls have coalesced, followed after an edentulous gap by 3 small teeth, isodont, and grooved on their outer faces. The fangs are relatively small. Those in a skull in my collection from a hamadryad 11 feet 5 inches only measure three-eighths of an inch *Palatine.*—7 to 8; anododont, isodont, grooved on their inner faces. *Pterygoid*. —9 to 14; anododont, scaphiodont; ridged on their outer and innerfaces. *Mandibular.*—14 to 18; anododont, scaphiodont; grooved on their outer faces.

DISTRIBUTION.—(a) General.—Peninsular India to the Himalayas, Assam, Burma, Indo-China to South China. The Andamans. Malay Peninsula and Archipelago to the Philippines.

(b) Local.—In Peninsular India (except in Orissa and Bengal) its distribution corresponds to the mountain ranges and their near vicinity. Mr. Baini Parshad in this Journal (Vol. XXIII, page 585) records one from the vicinity of Lahore. This is the only evidence of the species occurring in the Punjab, except in or near the Western Himalayas, that I am aware of. In this Journal (Vol. XVII, page 515) is mentioned a skin of a specimen killed at Palanpur near Deesa. Mr. Millard wrote to me of another example killed by Colonel Woodhouse at Kolhapore twenty miles from any jungle. The occurrence of specimens in such unusual localities may be accounted for by transportation on drift by rivers. Colonel Woodhouse mentioned that the Panchganga river was in flood, and passed the lower part of his garden at the time he killed his specimen. As far as I am aware, it does not occur in the Central Provinces.

It is no where a common snake, in fact in my experience it is uncommon throughout its Indian distribution. When anyone kills a hamadryad he considers rather an event in his life. The incident is widely known to all his neighbours, and in many instances an account of the adventure finds its way into print. This probably accounts for it appearing a commoner snake than is really the case.

It appears to favour the lower elevations of hills, but has been met with over 6,000 feet in the Nilgiris, in the Western Himalayas, *viz.*, Teneriffe above Coonoor, the Park at Mussoorie, and at Muktesar. In Orissa, Bengal, Assam, and Burma it is found as frequently at plain level as elevated tracts.